CLAIMS

We claim:

1. A detector for detecting a ligand in a fluid, the detector comprising

a first body;

a second body having a cantilever extending therefrom into a gap between the first and second bodies, the cantilever having two substantially parallel planar faces, wherein one of the planar faces has a receptor that binds specifically with the ligand immobilized thereon; and

a gapped optical waveguide extending across the first and second bodies and along the length of the cantilever, wherein the gap of the waveguide coincides with the gap between the first body and the distal end of the cantilever,

whereby binding of the ligand with the receptor induces bending of the cantilever, thereby misaligning the gapped ends of the waveguide and decreasing light coupling across the gap of the waveguide.

2. The detector of claim 1, wherein the waveguide is integral with the cantilever.

3. The detector of claim 1, wherein the fluid is one of a liquid and a gas.

4. The detector of claim 1, wherein the waveguide comprises a material selected from the group consisting of a semiconducting material, a dielectric material, and a polymer.

5. The detector of claim 1, wherein the second body comprises a cladding material for the waveguide.

6. The detector of claim 5, wherein the first body also comprises the cladding material.

7. The detector of claim 6, wherein the waveguide contacts the cladding material along substantially its entire length, except for the portion of the waveguide on the cantilever.

8. The detector of claim 1, wherein the first and second bodies are integral parts of a single substrate.

9. The detector of claim 1, wherein a first metallic layer is interposed between the receptor and the face of the cantilever.

10. The detector of claim 1, wherein the cantilever has a shape selected from the group consisting of substantially rectangular, wedge-shaped, and V-shaped, when viewed normal to the plane of the planar faces.

11. The detector of claim 1, wherein the second body has a plurality of the cantilevers extending therefrom into the gap between the first and second bodies, and wherein at least one gapped waveguide extends across the first and second bodies along the length of each of the plurality of cantilevers, the gap of each waveguide coinciding with the gap between the first body and the distal end of the corresponding cantilever.

12. The detector of claim 11, wherein at least two of the cantilevers individually have receptors for different ligands immobilized on the face thereof, whereby binding of one of the ligands with its receptor induces bending of the corresponding cantilever and misalignment of the gapped ends of the waveguide extending along the length of that cantilever.

13. The detector of claim 1, wherein the ligand is selected from the group consisting of cells, polypeptides, polynucleotides, carbohydrates, and combinations of these.

14. The detector of claim 13, wherein the ligand is a first polynucleotide.

15. The detector of claim 14, wherein the receptor is a second polynucleotide having a nucleotide sequence complementary to the nucleotide sequence of the first polynucleotide.

16. The detector of claim 1, wherein the receptor is a polynucleotide.

17. The detector of claim 1, wherein the receptor is a polypeptide.

18. The detector of claim 17, wherein the polypeptide is an antibody.

19. The detector of claim 1, wherein the ends of the waveguide distal from the gap therein are coupled with a light source and a light detector.

20. The detector of claim 1, further comprising a device coupled with the cantilever for inducing a regular vibration of the cantilever, whereby the frequency of vibration of the

cantilever can be assessed by the frequency of light coupling across the gap of the waveguide and whereby binding between the ligand and the receptor alters the resonant frequency of vibration of the cantilever.

21. A method of assessing occurrence in a fluid of a ligand that binds specifically with a receptor, the method comprising

contacting the fluid and a surface of a cantilever extending from a second body into a gap between the second body and a first body, wherein the receptor is immobilized on the surface and

assessing light coupling across the gap of a gapped waveguide extending across the first and second bodies and along the length of the cantilever, wherein the gap of the waveguide coincides with the gap between the first body and the distal end of the cantilever,

whereby binding of the ligand with the receptor induces bending of the cantilever, thereby misaligning the gapped ends of the waveguide and decreasing light coupling across the gap.

22. A method of assessing occurrence in a fluid of a ligand that binds specifically with a receptor, the method comprising

contacting the fluid and a surface of a cantilever extending from a second body into a gap between the second body and a first body, wherein the receptor is immobilized on the surface,

inducing a regular vibration of the cantilever, and

thereafter assessing light coupling across the gap of a gapped waveguide extending across the first and second bodies and along the length of the cantilever, wherein the gap of the waveguide coincides with the gap between the first body and the distal end of the cantilever,

whereby the frequency of vibration of the cantilever can be assessed by the frequency of light coupling across the gap and whereby binding between the ligand and the receptor alters the resonant frequency of vibration of the cantilever.

23. In a method of assessing occurrence in a fluid of a ligand that binds specifically with a receptor immobilized on a microscopic cantilever extending from a second body, wherein binding between the ligand and the cantilever induces deflection of the cantilever in the presence of the fluid, the improvement comprising

assessing deflection of the cantilever by assessing light coupling across the gap of an optical waveguide disposed across the second body, along the length of the cantilever, and

across a first body distally spaced from the cantilever, wherein the gap of the waveguide coincides with the space between the first body and the cantilever.

24. A method of making a detector for detecting a ligand in a fluid, the method comprising fabricating a device comprising

forming a gapped optical waveguide extending across a first body and a cantilever extending from a second body into a gap between the first and second bodies, wherein the gap of the waveguide coincides with the gap between the first body and the distal end of the cantilever, and;

immobilizing a receptor that binds specifically with the ligand on a surface of the cantilever.

25. The method of claim 24, wherein the device is fabricated by

depositing an optical waveguide onto a substrate;

coating the substrate with an etch-resistant mask, wherein the mask defines the first body, the second body, and the cantilever; and

etching the substrate to form the first body, the second body, the cantilever, and the gap of the waveguide.

26. The method of claim 25, further comprising coating the face of the cantilever with a metallic layer prior to immobilizing the receptor thereon.